

This claim has been amended to indicate that the tubular shield means is longer than the "shaft".

Paragraph 6

Claims 8, 15, 28 and 61 were rejected under 35 U.S.C. 112, second paragraph, for lacking an antecedent basis for limitations in the claims. Claim 8, as originally written, defined the shaft as not rotating with the tubular shield. This was a typographical error and should have been written, as now amended, that the shield rotates with the shaft.

Claims 15, 28 and 61 recite the limitation "disposing a wax that turns into a gas...". An amendment has now been inserted in the Specification, page 6, after line 20, to provide a sufficient antecedent basis for this limitation. Since the limitation was in original claims 15 and 28 as filed, it therefore forms part of the original disclosure.

Claims 11-14, 25-27, 52-54, 56 and 62-64 were objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

Accordingly, claim 11 has been rewritten as new claim 69 and combines the limitations of original claim 11, claim 1 (amended), and claim 7.

Claims 12-14 depend from new claim 69 and therefore are also believed to be allowable.

New claim 70 includes the limitations of claim 25 and intervening claim 18.

New claim 71 includes the limitations of claim 26 and intervening claim 18.

Claim 27 has been amended to depend from claim 71 and is therefore also believed to be in condition for allowance.

New claim 72 includes the limitations of claim 52 and intervening claims 50 and 46.

Claims 53, 54 and 56 now depend from new claim 72 and are also believed to be in condition for allowance.

New claim 73 includes the limitations of claim 62 and intervening claim 46.

New claim 74 includes the limitations of claim 63 and intervening claim 46.

Claim 64 has been amended to depend from new claim 74 and therefore is also believed to be allowable.

Claims 15, 28, 55 and 61 were indicated as being allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, and to include all the limitations of the base claim and any intervening claims.

New claim 75 includes the limitations of original claim 15, intervening claim 11 and base claim 7.

Claim 28 has been amended to overcome the 35 U.S.C. 112 rejection. New claim 76 includes the limitations of amended claim 28, intervening claim 26 and base claim 18 (amended).

Claim 55 has been amended to overcome 35 U.S.C. 112 objection. New claim 77 includes the limitations of amended claim 55 and base claim 46.

New claim 78 now depends from claim 77 and is therefore also believed to be allowable.

Claim Rejections 35 U.S.C. 102(b)

Claims 1-6, 16, 18-24 and 46-51 were rejected as being anticipated by Yedidiah; claims 1-4, 7-8, 10 and 16 were rejected as being anticipated by Gehrm and claims 1-5, 7-9 and 16 were rejected as being anticipated by Gilbert et al.

Independent claims 1, 16, 18, and 46 have been amended to more clearly define the subject matter, which Applicant regards as his invention. Specifically the pump is defined as having means connecting the shielding means to the shaft such that the shielding means and all internal components dispose therein rotate as a unit with the shaft.

Applicant's pump rotates at a sufficiently higher rate than other commercially-available pumps used in this environment that vibration has a significant impact on the life of the shaft and the shielding means. Consequently, Applicant dynamically balances the shaft assembly and the shielding to accommodate the high rotational speeds. In order to accomplish this balancing, the shaft, the shielding means and all internal components in the shielding means have to rotate with the shaft.

None of the cited art teaches this structure. For example, Yedidiah discloses a shaft that is disposed within a rotatable sleeve 24 and a fixed or stationary metallic tube 26. Tube 26 is disposed between the shield and the shaft and does not rotate with the shaft. This assembly could not be dynamically balanced as Applicant's invention because the tube does not rotate. Yedidiah

may be satisfactory for a slow speed pump but not for a high speed pump where vibration is important.

Similarly, Gilbert et al. discloses a rotating shaft 30 that is supported within a vertical stationary post 28. If post 28 is considered the equivalent of Applicant's shield, then it clearly does not meet the requirement that the shield must rotate with the shaft.

Similarly, Gehrm teaches of a rotatable shaft that is directly attached to the impeller but enclosed within pipe 22, which if considered as a shield, is a non-rotating component and clearly does not meet the amended language of Applicant's claims.

The cited references all have at least one stationary shield.

Applicant's structure, as defined in the independent and dependent claims, provides several other structural distinctions from the cited art. For example, although Applicant claims inner and outer tubular shields, multiple shields of identical material can be cemented together to form a single tube to increase its strength and to transmit higher torque. The quill shaft design can only transmit rotary motion to the ceramic shields, taking advantage of the material characteristics of the shield material.

The ceramic impeller can be detached without face seals or gaskets. The propeller does not effect the shaft integrity if the propeller (impeller) breaks or becomes loose or lost.

The torque is transmitted from the shaft to the ceramic shields that, in turn, transmit the torque to the impeller.


Applicant's ceramic shields are of the same material so that they have the same thermal characteristics. This permits the ceramic shields to be cemented together to form a unitary structure. The shields of the cited art are generally of different materials (Gehrm) or use a magic material (hard, soft, abrasion resistant, elastic, inert, corrosion resistant, etc.). Gilbert uses paper, silicone cement etc., materials that would dissolve in minutes in molten aluminum or zinc. (Silicone dissolves in aluminum very rapidly)

Applicant's design has been run without maintenance for over six months, the test was stopped to turn down the furnace, not due to failure of the pump.

It is believed that none of the pumps of the cited art are in use or were even manufactured because they did not function, satisfactorily.

For this reason, it is believed that independent claim 1, in amended form, and independent claims 16, 18 and 46 are in condition for allowance. The remaining claims, for the above reasons, depend from the independent claims are also believed to be allowable.

Respectfully submitted,



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